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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,403	03/01/2004	M. Selim Unlu	BU-021AX	1449

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BOSTON, MA 02109

EXAMINER

WILCZEWSKI, MARY A

ART UNIT	PAPER NUMBER
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2822

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/04/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/790,403

Applicant(s)

UNLU ET AL.

Examiner

M. Wilczewski

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 January 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) 1-12 and 27-31 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 13-23 is/are allowed.
- 6) ☒ Claim(s) 24-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 June 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office action is in response to the amendment submitted on January 8, 2007.

Drawings

One sheet of replacement drawings was received on June 15, 2006. These drawings are acceptable.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 24-26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The status of claim 26 has been incorrectly indicated in the amendment as ***withdrawn***. Claim 26 has not been withdrawn from consideration by the Examiner. Since claim 26 has not been amended, the status of claim 26 should be indicated as ***original***. However, since the limitation of claim 26 has been incorporated into claim 24, claim 26 should be cancelled, since it no longer limits the subject matter of claim 24 (see the objection to claim 26 below).

In addition, in claim 24, it is suggested that the step of *providing a first body of silicon having a layer of silicon dioxide on a surface thereof*, which is now in lines 18-19

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of the claim, be moved to the beginning of the claim (see claim 24 as presented in the Amendment filed on June 15, 2006) in order to provide antecedence for "the first body" in the subsequent bonding step of the claim.

In addition, claim 24 has been amended to recite that a silicon epitaxial layer is formed **on the silicon fractured at said boundary**. However, claim 24 recites the formation of this boundary in two steps, see lines 5-7 and lines 22-24 of claim 24. Therefore, it is unclear on which of the boundaries the epitaxial layer is formed. However, to be consistent with the specification (page 5, first paragraph), epitaxial layer 36 is grown on the silicon fractured at the boundary after the last separating step. It is suggested that the step of providing a silicon epitaxial layer in lines 16-17 be deleted from the claim and reinserted after the separating step in lines 27-28 by inserting: "**then** providing a silicon epitaxial layer on the silicon fractured at said boundary".

Claim Objection

Claim 26 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 26 depends from independent claim 24. Since the limitation of claim 26 has been incorporated into claim 24, claim 26 no longer further limits the method of claim 24.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 24-26 are again rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al., Patent Application Publication 2001/0032977, of record, in view of Yamazaki et al., US Patent 6,335,231, both of record.

Abe et al. disclose a method of fabricating a buried reflective layer in silicon by a method as shown in Figure 9 which comprises: providing a first silicon substrate having a silicon dioxide (A) layer on a surface thereof, providing a second silicon substrate 16, implanting hydrogen into the first silicon substrate to a predetermined depth (20) forming a boundary between the hydrogen-implanted silicon and the unimplanted silicon on either side thereof (paragraph [0059]), bonding the two substrates at room temperature (paragraph [0059]) and annealing the wafers at a temperature of 800-1100°C (paragraph [0050] and [0063]) to promote cleaving or fracturing (splitting, destacking) of the hydrogen implanted regions 20 and to strengthen the bond (paragraphs [0051] and [0063]), separating the silicon at the hydrogen boundary thereby exposing a separated surface and then repeating the above-identified steps, i.e., providing another silicon wafer having a silicon dioxide layer thereon, implanting hydrogen into that wafer, bonding that wafer to the exposed silicon surface and

separating to expose a separated surface (paragraph [0051], [0060], and [0064]). Abe et al. lack anticipation only of performing an heating step to a cleaving temperature, as recited in lines 10-16 of claim 24.

Yamazaki discloses a method of fabricating an highly reliable SOI substrate which comprises providing a first silicon wafer 101 having a layer of silicon dioxide 102 on a surface thereof (Fig. 1A), providing a second silicon wafer 104 (Fig. 1C), implanting hydrogen to a predetermined depth 103 in silicon wafer 101 thereby forming a boundary between hydrogen implanted silicon and unimplanted silicon on either side thereof, bonding the two silicon wafers together by heating to promote cleaving or fracturing of regions containing hydrogen from regions not containing hydrogen (Figs. 1C and 1D) by first heating at 400 to 600 °C to cause cleaving followed by a second heating step at 1050 to 1150 °C to strengthen the bond (col. 6, lines 16-32), separating the silicon at the hydrogen boundary thereby exposing a separated surface (Figs. 1D and 1E).

Yamazaki teaches a wafer bonding process that is very similar to that of Abe et al. Yamazaki clearly teaches to bond the wafers and to perform a first heat treatment at a cleaving temperature in order to promote cleaving of the regions containing hydrogen from those regions not containing hydrogen and to perform a second heat treatment at a bond strengthening temperature to strengthen the bond between the two wafers. Yamazaki clearly teaches that this two-step heat treatment yields a stabilized bonding interface, which is very strong (see col. 6, lines 33-37, of Yamazaki). Therefore, it would have been obvious to one skilled in the art that the two-step heat treatment of

Yamazaki could be substituted for the single annealing step of Abe et al. thereby yielding a very strong, stabilized bonding interface.

Yamazaki also teaches to form a silicon epitaxial layer on the silicon fractured at the boundary, see Figures 3A-3F and column 6, lines 64-67. It is well known in the art that forming a device in an epitaxial layer enables the doping concentration of the device to be accurately controlled and enables the growth of a high quality layer that is both oxygen and carbon free. Therefore, it would have been obvious to one skilled in the art to form an epitaxial layer in the known method of Abe et al. so that the optical function device of Abe et al. could be formed in the epitaxial layer, since the epitaxial layer would be of a higher quality than the substrate for forming the device.

Response to Arguments

Applicant's arguments with respect to claims 24-26 have been considered but are moot in view of the new ground(s) of rejection.

Allowable Subject Matter

Claims 13-23 are allowable over the prior art of record.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Election/Restrictions

This application contains claims 1-12 and 27-31 drawn to an invention nonelected with traverse in the Response filed December 5, 2005. Although Applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, a complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to M. Wilczewski whose telephone number is (571) 272-1849. The examiner can normally be reached on Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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